

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Expanding Flexible Use of the)	GN Docket No. 18-122
3.7-4.2 GHz Band)	
)	
Petition for Rulemaking to Amend and)	RM-11791
Modernize Parts 25 and 101 of the)	
Commission's Rules to Authorize and)	
Facilitate the Deployment of Licensed)	
Point-to-Multipoint Fixed Wireless)	
Broadband Service in the)	
3.7-4.2 GHz Band)	
)	
Fixed Wireless Communications Coalition,)	RM-11778
Inc., Request for Modified Coordination)	
Procedures in Band Shared Between the Fixed)	
Service and the Fixed Satellite Service)	

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I. INTRODUCTION AND SUMMARY

Consumers in the United States enjoy a vibrant television marketplace with many choices for how to access a large amount of high quality, original content. Programming networks provide video content to more than 100 million American households, including 51.9 million cable video customers. Consumers also have other options, including broadcast and over-the-top services. No matter how they watch, C-band downlink spectrum in the 3.7-4.2 GHz band is a critical link in the television distribution chain between content creators and American consumers.

In its Notice of Proposed Rulemaking (NPRM),¹ the Commission proposes changes to the 3.7-4.2 GHz ecosystem that have the potential to disrupt significantly how television is delivered today to millions of American households. As the Commission evaluates proposals for expanding terrestrial wireless use of the band, it should ensure that any successful proposals incorporate four core protections for incumbent C-band users:

1. Ensuring no adverse impact or disruption to all of today's existing C-band services with room for growth, technological evolution, and requisite back-up capacity;
2. Technical rules, validated by appropriate studies and testing, must fully protect earth station operators from harmful interference that could result from new adjacent mobile services and any new in-band fixed point-to-multipoint (P2MP) services;
3. Earth station operators must be made whole for the costs that they incur in any transition to accommodate new services; and
4. The Commission should retain its full-band, full-arc policy to accommodate the operational needs of 3.7-4.2 GHz earth station operators, including the flexibility to repoint antennas and change frequencies, sometimes on short notice.

¹ *Expanding Flexible Use of the 3.7-4.2 GHz Band*, Notice of Proposed Rulemaking, GN Docket No. 18-122, RM-11791, RM-11778, FCC 18-91 (rel. July 13, 2018) (NPRM).

Each of the approaches teed up in the Commission's NPRM presents particular concerns for C-band customers that should be addressed. For example, a private, market-driven approach to clearing a portion of the 3.7-4.2 GHz band presents particular concerns for the public interest, as the incentives of the proposed participants in negotiations may not be co-extensive with those who use the spectrum today as transponder lessees and earth station operators. Moreover, the Commission has been delegated the authority to make spectrum policy decisions in the public interest and may not merely cede that responsibility to private parties. Consequently, if it favors a market-led approach to clearing, the Commission should ensure that proponents disclose in detail in their transition plan how they will protect today's C-band users, including their laboratory and field test results demonstrating that adjacent mobile operations will not cause harmful interference to FSS users. If it adopts an auction approach, auction design should ensure that earth station operators and other satellite customers may participate directly in mechanisms for determining the socially optimal amount and value of cleared spectrum. And the Commission should not authorize co-channel shared use by fixed point-to-multipoint (P2MP) users in the remainder of the band. Proponents have not demonstrated that harmful interference issues and concerns around the operational needs of earth station operators (that must make frequency and antenna pointing changes on short notice), can be resolved.

Finally, the Commission should not limit the deployment or registration of new earth station sites or antennas. The 3.7-4.2 GHz band will continue to play an important role in meeting the needs of television content providers and cable system operators for years to come, and the Commission should enable these parties to make robust, efficient use of the spectrum that remains available for their operations after any transition. The Commission also should not

require earth station operators to submit new, burdensome information where the submission of such information would result in minimal public benefit.

II. CABLE OPERATORS AND PROGRAMMERS RELY ON THE 3.7-4.2 GHZ BAND TODAY TO PROVIDE VALUABLE SERVICES TO CUSTOMERS

As NCTA and many other commenters in this proceeding (and in response to the mid-band Notice of Inquiry) have discussed at length in their filings, a robust ecosystem of C-band operations makes extensive use of the band today for content and data delivery.² Particularly relevant to NCTA's members, the 3.7-4.2 GHz band provides a critical link in the television distribution chain between programmers and the cable system operators that distribute that content to customers.

The cable industry is a vibrant and growing part of the U.S. economy, with total U.S. economic impact of \$421 billion in 2016 and supporting 2.9 million U.S. jobs.³ Moreover, “annual spending on programming by basic [cable] networks grew more than six-fold from \$1.4 billion in 1990 to nearly \$9.2 billion for 2002, and has since more than quadrupled to over \$38 billion in 2016,” dramatically increasing the original content available to consumers.⁴ NCTA's

² Comments of the American Cable Association, GN Docket No. 17-183, at 4-11 (filed Oct. 2, 2017) (ACA Comments); Comments of the Content Companies, GN Docket No. 18-122, at 2-4 (filed May 31, 2018) (Content Companies Mobile Now Comments); Comments of the National Association of Broadcasters, GN Docket No. 18-122, at 1-2 (filed May 31, 2018) (NAB Mobile Now Comments); Joint Comments of Intel Corporation, Intelsat License LLC, and SES Americom, Inc., GN Docket No. 18-122, at 2-4 (filed May 31, 2018) (Intel, Intelsat, SES Mobile Now Comments); Comments of the Satellite Industry Association, GN Docket No. 18-122, at 2-6 (filed May 31, 2018) (SIA Mobile Now Comments).

³ NCTA – The Internet & Television Association, *Unleashing Connectivity and Entertainment in America*, at v (2016), <https://www.ncta.com/sites/default/files/2017-08/Bortz%20Report%20FINAL%20511.pdf>.

⁴ *Id.* at 30-31.

members deliver programming to more than 100 million American households, including 51.9 million cable video customers.

C-band downlink spectrum in the 3.7-4.2 GHz band (referred to herein as C-band or 3.7-4.2 GHz) constitutes an important input to enable economic value creation and the seamless delivery of television services to American consumers. NCTA's largest operator members receive, on average, more than 80 percent of their primary signals of cable programming via C-band, using an average of 128 transponders and communicating with an average of 18 satellites. NCTA's mid-size operators are, by some metrics, even more reliant on C-band, in one case receiving 95 percent of the programming delivered to customers via C-band and communicating with more than 20 satellites. And as NCTA has previously noted, cable system operators have deployed thousands of earth station antennas to receive the programming that they distribute to customers.⁵

Some of NCTA's operator members receive national and regional content at cable headends throughout their footprint. Others, particularly some large operators, receive national programming at central and regional network operations centers (NOCs) where the content is groomed and then sent out to headends via fiber. Even where operators receive some programming at headends via fiber, they continue to rely on C-band to meet local and regional needs, with local and regional sports and news programming and other channels designed for particular communities distributed to headends primarily via C-band. For example, at one headend location in Northern Virginia, while most national content arrives at the facility via

⁵ Comments of NCTA – The Internet & Television Association, GN Docket No. 17-183, at 3 (filed Oct. 2, 2017).

fiber, C-band plays an important role in delivering diverse content to meet local needs, including a Korean language channel.

In addition to serving an important role in video service delivery, C-band is also critical for onsite newsgathering and live event coverage. Nomadic C-band trucks can be located near to a content origination venue and used to uplink live content back to NOCs (using, for example, the 5925-6425 MHz band). However, these trucks also receive (on 3.7-4.2 GHz) feeds from other venues to integrate into the live feed sent to the NOC (for example, in the context of concerts or multi-venue live events), and also use the downlink band to monitor the performance of their live feed. Real-time monitoring at the truck ensures high-quality video delivery and enables real-time remediation of any problems.

Some of NCTA's members (such as General Communication Inc. (GCI)) also use C-band for other communications services, including providing broadband access to rural and remote areas. According to GCI, many of its C-band sites

serve customers residing in the most rural and remote areas of the country that rely exclusively on satellite technology for the provision of basic telephone service, medical service, and distance-learning. Federal agencies, such as the Federal Aviation Administration ("FAA"), for example, also depend on GCI's operations in this spectrum to assist pilots in determining local weather conditions throughout the state, and US military operations have been utilizing commercial satellite operations for many years. Many of these critical services, if interrupted, could result in life-threatening situations.⁶

C-band use for television distribution and other services meets particular public interest needs. The value of these services may not be fully realized in economic calculations looking at transactions from the perspective of private companies. In addition to facilitating the distribution of programming, C-band users provide many services with the characteristics of a public good.

⁶ Comments of GCI Communication Corp., GN Docket No. 18-122, at 3 (filed May 31, 2018).

For example, C-band satellites provide services related to national security and protecting public safety, including missile warning systems and the distribution of important weather forecasts and related alerts.⁷ In addition, entities such as National Public Radio use C-band to distribute Emergency Alert System messages.⁸ A private market may tend to undervalue these C-band services because private actors may not fully account for the social benefits of these activities. Congress has delegated to the Commission the authority and responsibility to regulate spectrum allocations in the public interest,⁹ a role that the Commission cannot merely cede to the market. If the Commission tasks private actors with evaluating the costs and benefits of reallocating a portion of C-band spectrum, their determinations may undervalue existing C-band services and lead to economically inefficient under-provisioning of spectrum to support such services. The Commission should play a key role in ensuring that the economic value of today's C-band services, including those resembling public goods, is accurately reflected when determining whether it is socially efficient to reallocate a portion of the C-band for terrestrial wireless operations.

III. THE COMMISSION SHOULD PROVIDE CERTAIN CORE PROTECTIONS TO ENSURE THAT 3.7-4.2 GHZ BAND INCUMBENTS CAN CONTINUE TO PROVIDE THE SAME HIGH-QUALITY SERVICE TO CUSTOMERS

Any approach the Commission seriously considers for enabling expanded terrestrial wireless broadband use of the 3.7-4.2 GHz band should provide four key protections to existing operators. Such protections will ensure that NCTA's members can continue to provide

⁷ See *id.*; see also Letter from Michele C. Farquhar, Counsel to SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183, at Attachment, p. 1 (filed Feb. 21, 2018).

⁸ Comments of National Public Radio, Inc., GN Docket No. 17-183, at 9 (filed Oct. 2, 2017) (NPR Comments).

⁹ See generally 47 U.S.C. § 303.

uninterrupted service to television customers. Those core protections include: (1) preventing adverse impact to all of today's existing services, including providing room for growth, technological innovation, and requisite back-up capacity; (2) adopting technical rules that fully protect earth station operators from harmful interference that could result from new adjacent mobile services and any new in-band fixed P2MP services; (3) providing compensation for the costs that 3.7-4.2 GHz customers will incur in any transition to accommodate new services; and (4) retaining the full-band, full-arc policy to account for the needs of 3.7-4.2 GHz earth station operators to repoint antennas and change frequencies, sometimes on short notice.

A. The Commission Must Prevent Adverse Impact to 3.7-4.2 GHz Users, Including Supporting All of Today's Services and Accommodating Forecasted Future Growth

Proposals in the record to date vary widely regarding how much spectrum could be cleared to accommodate new mobile services. The satellite operators (now working together under the auspices of the C-Band Alliance (CBA)) have stated that they believe they can clear 200 megahertz.¹⁰ Nokia has suggested that 80-100 megahertz be cleared for every major wireless operator,¹¹ a suggestion echoed by Commissioner O'Rielly.¹² Intel and Verizon also

¹⁰ C-Band Alliance, *C-Band Alliance Increases to 200 MHz Its FCC Proposal for Spectrum Repurposing in the U.S. to Support Nationwide 5G Deployment*, Press Release (Oct. 22, 2018), https://c-bandalliance.com/wp-content/uploads/2018/10/C_Band_Alliance_Press_Release_22_October_2018_final.pdf.

¹¹ Letter from Jeffrey Marks, Senior Counsel - Policy and Regulatory, Nokia, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 14-177, 15-319, 17-183, 17-258; IB Docket Nos. 97-95, 15-256; WC Docket No. 18-89; WT Docket Nos. 10-112, 17-79, at 2 (filed May 22, 2018).

¹² Michael O'Rielly, Commissioner, FCC, Remarks before the 7th Annual Americas Spectrum Management Conference, Washington, D.C., at 4 (Oct. 2, 2018), <https://www.fcc.gov/docum>

believe that significantly more than 100 megahertz can be cleared.¹³ In the NPRM, the Commission declines to propose a specific clearing target, but does note that its goal is to “adopt a mechanism that will repurpose a socially efficient amount of spectrum in the band.”¹⁴

Any repurposing of 3.7-4.2 GHz spectrum will only be socially efficient if the operations of all existing band users can be accommodated in the remaining spectrum, with no adverse impact to all existing operations and adequate margin for anticipated future growth and requisite back-up capacity. As the record established in the proceeding to date clearly indicates, there is no sufficiently ubiquitous, reliable, and cost-effective alternative to C-band spectrum available today to accommodate incumbent needs.¹⁵ Without such a viable alternative, the Commission should exercise caution in considering whether a portion of the 3.7-4.2 GHz band can and should be reallocated for new uses. Moreover, it should not adopt a mobile allocation for the entire band, but only any portion of the band that the Commission determines can be cleared today for terrestrial wireless use while still accommodating all existing C-band customers.

Fiber is not an equivalent alternative transmission technology. Although some have

ent/orielly-remarks-americas-spectrum-management-conference (suggesting that “a sufficient amount of [3.7-4.2 GHz] spectrum must be made available, at least 200 to 300 megahertz”).

¹³ See Letter from Peter K. Pitsch, Associate General Counsel, Intel, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183, at 1 (Apr. 26, 2018); Letter from Charla Rath, Vice President, Wireless Policy Development, Verizon, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183, GN Docket No. 18-122, at 1 (May 16, 2018).

¹⁴ NPRM ¶ 81.

¹⁵ ACA Comments at 16-18; Content Companies Mobile Now Comments at 3-4; SIA Mobile Now Comments at 3-6; NAB Mobile Now Comments at 2.

suggested that today's C-band content distribution networks could be transitioned to fiber,¹⁶ proponents significantly understate the challenges inherent in such a transition. First, fiber networks do not provide the ubiquity of C-band satellite services. Where C-band spectrum can readily ensure that the same programming reaches both Manhattan and rural Montana in a cost-effective manner, fiber often is sparsely deployed, particularly in rural areas. A collaborative effort led by the University of Wisconsin to map long-haul U.S. fiber-optic deployment in the continental United States notes a "pronounced absence of infrastructure," particularly in rural areas like the upper plains and four corners regions on the country, as shown in Figure 1, below.¹⁷ In large sections of the country, it will not be feasible or cost-effective to connect cable headends to fiber.

FIGURE 1: U.S. Long Haul Fiber Map¹⁸



¹⁶ See, e.g., Comments of CTIA, GN Docket No. 17-183, at 4 (filed Oct. 2, 2017); Comments of Verizon, GN Docket No. 17-183, at 17-19 (filed Oct. 2, 2017).

¹⁷ Ramakrishnan Durairajan, et al., *InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure*, at 4 (2015), http://pages.cs.wisc.edu/~pb/tubes_final.pdf.

¹⁸ *Id.* at 5.

Moreover, fiber does not provide the 99.999% reliability¹⁹ that NCTA's members have come to rely on from C-band. Unlike C-band spectrum, fiber connectivity is subject to disruption from cuts caused by construction, severe weather, and other damage.²⁰ To achieve comparable reliability to C-band spectrum, providers would need multiple redundant fiber links with geographic routing diversity,²¹ adding to both the complexity and cost of transitioning earth stations to fiber.

T-Mobile has suggested that urban C-band earth stations could be moved to rural areas and backhauled by fiber and analyzes at a high level two example markets (Phoenix and Chicago).²² The analyses have several significant flaws and provide no reliable basis for determining whether it would be feasible or cost effective to make alternative fiber transmission arrangements for C-band customers. Strikingly, the Phoenix discussion provided no cost estimates at all for its suggestion that C-band earth stations within 60 km of the Phoenix Cellular Market Area (CMA) could be relocated. The distances over which fiber would need to be laid range from 80 to 160 miles, so relocating earth stations or building new ones and connecting to

¹⁹ See Kurt Riegelman, *The Media Network for the Future: Introducing Galaxy 30*, Intelsat (Jan. 11, 2018), <http://www.intelsat.com/news/blog/the-media-network-for-the-future-introducing-galaxy-30>.

²⁰ See, e.g., Todd Kunz, *Cut Internet and Fiber Cable Affecting Schools, Homes and Businesses*, LOCAL NEWS 8 (Sept. 26, 2018), <https://www.localnews8.com/news/cut-internet-and-fiber-cable-affecting-schools-homes-and-businesses/799855115>; see also Marguerite Reardon, *Fiber Outages Slow Cell Recovery After Hurricane Michael*, CNET (Oct. 16, 2018), <https://www.cnet.com/news/fiber-outages-slow-cell-recovery-after-hurricane-michael>.

²¹ Reply Comments of SES Americom, Inc., GN Docket No. 17-183, at 16 (filed Nov. 15, 2017); ACA Comments at 17 n.34.

²² Letter from Steve B. Sharkey, Vice President, Government Affairs, T-Mobile, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 18-122, 17-183, at 2-3 (filed June 15, 2018) (T-Mobile Letter).

other sites via fiber would likely be an expensive undertaking, particularly with redundant, geographically diverse routes. (Despite recognition by the Chicago study that obstacles such as highways and historic and other protected areas meaningfully impact the costs of fiber installation,²³ the Phoenix study's proposed fiber lines cross major highways, nature preserves, and other protected areas, which would further increase costs.) Without any cost estimates, the study completely overlooks a critical aspect in determining the viability of relocating earth stations to allow for mobile service in the C-band frequencies in Phoenix or anywhere else.

Equally problematic, T-Mobile provides no analysis regarding how earth station operators 60 km or more from the Phoenix CMA would be protected from harmful interference. The record suggests that exclusion zones between 65-75 km around an earth station could be necessary to prevent harmful interference from co-channel mobile operations.²⁴ The 60 km that T-Mobile suggests may not be sufficient to prevent harmful interference to relocated earth stations from mobile operations within the Phoenix CMA.

Finally, the Phoenix analysis fails to consider the broader implications of T-Mobile's proposal. Even assuming that earth stations could be moved 60 km outside of Phoenix and protected from harmful interference caused by mobile operations within the Phoenix CMA, this would appear to prevent mobile deployment in much of the rest of Arizona and in other major metro areas. There are six other metropolitan statistical areas (MSAs) in Arizona, with a

²³ *Id.* at Attachment 2, p. 30.

²⁴ Letter from Gerry Oberst, President, SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183, at 1 (filed Mar. 2, 2018) (SES March Letter); Comments of Ericsson, GN Docket No. 17-183, at Attachment p. 3 (filed Oct. 2, 2017) ("Co-channel sharing between IMT Macro and FSS earth receivers leads to separation distances as high as 50-70 km for I/N values below -6 dB and FSS elevation angle of 5 degrees.").

combined population of more than 1.8 million people. The Phoenix Study hypothesizes that the Associated Press could discontinue its use of Phoenix earth stations and instead rely on earth station operations in Yuma, Lake Havasu City, or Prescott,²⁵ but each of these options are in their own MSAs, each with over 200,000 people. Clearing the Phoenix CMA and surrounding earth stations while keeping earth station sites in these cities would prevent mobile deployment to those locations.

Moreover, several of the locations that, under T-Mobile's plan, would continue to house earth stations are within 60-70 km of other major CMAs, including Los Angeles and Las Vegas.²⁶ This suggests that carriers would either lose an opportunity to deploy in one of these major metro areas, or earth stations would need to be moved even further into rural geographies, greatly increasing the amount of fiber—and geographic obstacles and challenges to negotiate in terms of time-consuming planning and permits—that would be required to connect the new site to the old. Overall, T-Mobile's own analysis appears to indicate that applying its approach across the United States would create “Swiss cheese 5G”—service in a very few urban centers, with holes covering much of the country, a challenge the Commission recognizes in the NPRM.²⁷

The Chicago market analysis by Roberson and Associates, LLC suffers from similar flaws. On the issue of geographic separation, the Roberson analysis appears not to provide even the 60 km separation from the CMA boundary that the Phoenix slides assume. In fact,

²⁵ T-Mobile Letter at Attachment 1, p. 6.

²⁶ For example, Lake Havasu City is right on the border of San Bernardino County in California, which is part of the Los Angeles CMA and it is also approximately 65 km from the border of Clark County, Nevada, which corresponds to the Las Vegas CMA.

²⁷ NPRM ¶ 52.

Roberson's Option 1 (moving earth stations outside of Chicago) appears only to consider moving headend antennas 20 miles outside of Cook County, while the CMA for Chicago also includes, for example, Lake, McHenry, Kane, DuPage, and Will Counties. Moving headend earth stations 20 miles from Chicago would not put them outside of the relevant CMA, much less the 60 km outside the CMA assumed in the Phoenix study to be necessary to avoid harmful interference.

As with the Phoenix analysis, moving headends 50 to 100 miles might permit deployment of mobile services in the Chicago CMA but, due to harmful interference concerns, it would prevent mobile service deployment in other significant markets. Five CMAs in Illinois abut the Chicago CMA, and people located in these five CMAs would not receive mobile service under T-Mobile's proposal. In addition, there are seven CMAs in Wisconsin within approximately 30 miles of the Chicago CMA, including some that abut it. These CMAs serve other major metro areas such as Milwaukee, where the relevant CMA is home to well over 1 million people. So mobile service operators would need to choose between serving either their Chicago or Milwaukee customers with mobile service, but not both, or relocating earth stations farther than 50-100 miles from their current locations into truly rural areas where fiber deployment may be impossible or cost prohibitive and where the practicalities of ongoing maintenance of the receive site may prove challenging.

Although the Chicago study does provide a cost estimate, its assumptions appear to be unsupported. First, Roberson appears to pull out of thin air its assumptions regarding cable headends. Without support, it assumes a total of approximately 4,800 cable headed receivers nationwide, only "a few hundred" of which would be located in urban areas.²⁸ In Chicago

²⁸ T-Mobile Letter at Attachment 2, p. 11.

specifically, under its Option 1 approach, Roberson assumes 71 cable earth stations would need to be transitioned (without indicating where it obtained this estimate), with fifty percent of those earth stations relocated 20 miles away, and the others evidently not actually relocated, but completely transitioned to fiber (without explanation for these assumptions).²⁹ Second, Roberson provides no support for its assumption that fiber connectivity could be achieved at a price of \$20/foot, or what that \$20 is meant to include. Third, although Roberson acknowledges the need for multiple, redundant fiber lines to achieve adequate reliability,³⁰ it does not appear to build the cost of redundant lines into its estimates.³¹ And finally, Roberson's analysis also does not appear to account for the costs associated with obtaining rights of way for any new fiber that must be deployed, or for any operating costs.

Given their lack of specificity and supporting analysis, the Phoenix and Chicago studies are of very limited utility in determining whether or at what cost C-band earth stations could be relocated or transitioned to fiber. The Commission should not rely upon them in its own evaluation. Instead, the Commission should recognize that, because fiber does not provide the ubiquity, reliability, or affordability of C-band, it is not an equivalent, alternative distribution mechanism for television programming.

Other satellite spectrum bands are not equivalent alternatives to C-band. Alternative satellite spectrum bands, such as Ku- and Ka- are not equivalent substitutes for C-band due to rain fade and may not offer sufficient available spectrum to accommodate today's C-band

²⁹ *Id.* at Attachment 2, p. 25.

³⁰ *Id.* at Attachment 2, p. 14.

³¹ *Id.* at Attachment 2, pp. 25-26.

services in any case.³² The International Telecommunication Union has noted that C-band spectrum is “important for FSS because atmospheric absorption is lower in this frequency band, thus improving reliability and coverage, particularly in case of severe rain fade conditions.”³³ “On the other hand, the severe rain fading effects on Ku-band or Ka-band signals require operators to create smaller beams focused on areas of high demand and population density, in order to maintain the required quality of service in an economically viable manner.”³⁴ Ka-band, in particular, poses challenges for achieving sufficiently reliable service. “Ka-band transmission is severely degraded by adverse weather conditions . . . additional atmospheric losses due to rainfall can exceed 50dB” meaning that conventional approaches to overcome fade margin “do not always compensate sufficiently for the losses, when it comes to meeting the needs of high availability services.”³⁵ Consequently, transitioning services like television delivery that demand high availability from C-band to Ku- or Ka- frequencies should not be considered an equivalent

³² Comments of AT&T Services, Inc., GN Docket No. 17-183, at 5, 7, 8 (filed Oct. 2, 2017) (AT&T Comments); Content Companies Mobile Now Comments at 3; Comments of the Satellite Industry Association, GN Docket No. 17-183, at 15 (filed Oct. 2, 2017); Comments of SES Americom Inc., GN Docket No. 17-183, at 3 (filed Oct. 2, 2017); ACA Comments at 16 n.30.

³³ International Telecommunication Union, *CPM Report on Technical, Operational and Regulatory/Procedural Matters to Be Considered by the 2007 World Radiocommunication Conference* 36 (2007), https://www.itu.int/dms_pub/itu-r/md/07/cpm/r/R07-CPM-R-0001!R1!PDF-E.pdf.

³⁴ José Albuquerque, *Satellite Operators Challenge Mobiles' Use of C-Band*, International Telecommunication Union (2007), <http://www.itu.int/itunews/manager/display.asp?lang=en&year=2007&issue=08&ipage=C-band>.

³⁵ Michael Waldow, *Maximizing Network Uptime by Ground Station Diversity*, Via Satellite (2015), <http://interactive.satellitetoday.com/via/october-november-2015/maximizing-ka-band-network-uptime-by-ground-station-diversity>.

alternative transmission path.³⁶ If the Commission were to consider alternative spectrum bands to accommodate today's C-band services, such bands would need to be true equivalents for what C-band offers today.

Compression and video coding technologies. Although the adoption of advanced video coding technologies over time could in theory reduce the amount of spectrum necessary to support video delivery, it could also undermine the quality of video content and result in significant costs to replace equipment.³⁷ Efficiency gains resulting from new compression may also be cancelled out by the simultaneous, widespread adoption of higher resolution video, which requires additional bandwidth. NCTA understands that the widespread adoption of new compression technologies such as HEVC would require the deployment of new equipment in both programmer and operator facilities. Programmers would likely also incur significant costs in licensing the IP rights necessary to deploy these technologies. Adopting advanced video coding schemes may also result in technical obstacles. For example, further compressing video can result in quality trade-offs.³⁸ Consumers today expect unprecedented television quality, and compression must be carefully implemented to avoid an undesirable impact on the end-user experience, including on both picture and sound quality and latency.

Even if the technical, operational, and cost obstacles to widespread implementation of advanced compression technologies could be overcome in the timeframe needed to clear additional spectrum for terrestrial mobile services, the advances may be more than offset by the

³⁶ See NPRM ¶ 107.

³⁷ See *id.* ¶ 106.

³⁸ Miroslav Uhrina et al., *Impact of H.264/AVC and H.265/HEVC Compression Standards on the Video Quality for 4K Resolution* 1 (2014) (“[C]ompression technology can be considered as one of the main factors that influence the video quality.”).

simultaneous adoption of advanced transmission standards such as ultra-high-definition. Over time, NCTA's members anticipate that customer demand for high resolution pictures on larger home television screens will lead to the adoption of ultra-high-definition resolution.

Transmitting a higher-quality picture requires more bandwidth—“[b]ecause every 4K frame contains four times the information of HD, 4K content is four times more bulky than regular HD content in terms of its raw file size.”³⁹ Therefore, as with previous industry upgrades in compression and resolution, the bandwidth demand of higher resolution video may more than cancel out efficiencies gained in the deployment of advanced compression technologies.⁴⁰ Consequently, the Commission should not assume that a costly move to these new technologies would reduce C-band spectrum usage and enable reallocation of spectrum.

No other transmission path or technological solution exists today that could match the reliability, ubiquity, and affordability of C-band spectrum. Any approach the Commission may consider to facilitate potential terrestrial mobile use of a portion of the band must prevent adverse impacts to all of the current and future C-band services, with adequate margin for growth. Because significant uncertainty remains regarding how much spectrum could be cleared while still accommodating all C-band customers, the Commission should not, as it has

³⁹ Nick Pino & Jon Porter, *5K and Ultra HD: Everything You Need to Know About the Hot New Resolution*, TechRadar (Mar. 8, 2018), <https://www.techradar.com/news/television/ultra-hd-everything-you-need-to-know-about-4k-tv1258884>.

⁴⁰ See SIA Mobile Now Comments at 5. For example, if HEVC/H.265 requires 50 percent of the bit rate of AVC/H.264, while UHD is four times the raw pixel rate of HD, the net result is a need to double capacity. If High Dynamic range is also deployed, it requires using 10-bit pixels instead of today's 8-bit pixels, another 20 percent increase in the required capacity.

proposed,⁴¹ adopt a mobile allocation for the entire 3.7-4.2 GHz band. Instead, it should allocate for terrestrial mobile use only any portion of the band that it determines can be cleared today for terrestrial wireless use (with an appropriately sized transition band) while still accommodating all existing C-band customers.

B. Earth Stations Receiving on 3.7-4.2 GHz Must be Protected from Harmful Interference

As many commenters have noted,⁴² C-band earth stations receiving signals from satellites more than 35,000 km away are especially vulnerable to harmful interference. Additional noise introduced by new co-channel operations or new operations in adjacent bands poses a significant risk to the continued viability of C-band operations. The Commission must take steps to ensure that existing users can continue to operate in the spectrum that remains available for their use without harmful interference.⁴³ To that end, proponents of expanded terrestrial wireless use must file detailed technical information for review by the Commission and affected stakeholders, including field and laboratory test reports, demonstrating how protection from harmful interference can be achieved under real-world conditions.

Band Split. If the Commission reallocates a part of the 3.7-4.2 GHz band for terrestrial mobile use while permitting FSS operations to continue in the remaining spectrum, it will need

⁴¹ NPRM ¶¶ 55-56.

⁴² SIA Mobile Now Comments at 6; Comments of the Content Companies, GN Docket No. 17-183, at 6 (filed Oct. 2, 2017); Comments of General Communication, Inc., GN Docket No. 17-183, at 11-13 (filed Oct. 2, 2017); NPR Comments at 10-11.

⁴³ Consideration of what constitutes harmful interference should include maintaining the necessary link margins to ensure reliable operation during rain and adverse atmospheric conditions.

to build adjacent-channel interference protection into its technical rules and into the cost recovery it provides for existing C-band customers. First, the Commission should adopt an adequate transition band between new, high-power terrestrial users and remaining adjacent FSS services.⁴⁴ It became clear in the Commission's 3.5 GHz proceeding that an out-of-band emission (OOBE) limit for terrestrial, high power users, without spectral separation in the form of a guard band, made it difficult to accommodate the needs of both the mobile community and adjacent C-band users. Mobile users asked the Commission for a more relaxed out-of-channel mask that would accommodate higher power operations on wider-bandwidth channels, which the Commission ultimately refused to accommodate at the band edge for base station equipment, due to interference concerns raised by adjacent C-band operators.⁴⁵ The Commission can avoid repeating the same debate in this docket by adopting a transition band in addition to an appropriate OOBE limit, along with appropriate power and antenna height limitations for mobile users.

The 3.5 GHz proceeding also provides the Commission with a recent example limiting out of band emissions from mobile users to adjacent C-band incumbents. However, because the power levels proposed for new flexible use operations in the lower portion of the 3.7-4.2 GHz band exceed the power levels adopted for Citizens Broadband Radio Service (CBRS) operations, the Commission will likely need to adopt a more conservative OOBE limit (plus a transition band, as noted above) to protect today's C-band operations at the band edge between remaining

⁴⁴ See NPRM ¶ 172.

⁴⁵ See *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, GN Docket No. 17-258, FCC 18-149, ¶¶ 126-31, 133-34 (rel. Oct. 24, 2018).

FSS users and any new adjacent terrestrial wireless operators. In the 3.5 GHz context, the Commission adopted limits of -25 dBm/MHz beyond 10 megahertz outside of the band edge and -40 dBm/MHz above 3720 MHz (20 megahertz beyond the band edge),⁴⁶ where the maximum EIRP of adjacent CBRS devices was limited to 47 dBm/10 MHz.⁴⁷ Here, the Commission proposes a higher general power level of 1640 watts/MHz EIRP for emission bandwidths greater than one megahertz, which it proposes to increase to 3280 watts/MHz in rural areas.⁴⁸ And yet, the Commission proposes a less restrictive OOB limit than what it adopted in 3.5 GHz to protect adjacent users (-13 dBm/MHz at the authorized channel edge).⁴⁹ It will likely “be necessary to adopt more stringent out of band emission limits beyond the edges of the band” in order to ensure coexistence of new adjacent mobile users with remaining FSS operations.⁵⁰

Note that the introduction of new, high-power adjacent-channel operations would require installation of a new filter on every one of the thousands of deployed earth stations (and possibly also a new Low Noise Block downconverter (LNB) in some cases).⁵¹ C-band earth stations listening for faint signals from the satellite require filters to block out noise from adjacent mobile transmissions. Provision of adequate cost recovery to C-band users⁵² affected by the

⁴⁶ 47 C.F.R. § 96.41(e)(1)-(2).

⁴⁷ *Id.* § 96.41(b).

⁴⁸ NPRM ¶ 164.

⁴⁹ *Id.* ¶ 168.

⁵⁰ *Id.* ¶ 169.

⁵¹ *See* Letter from Henry Gola, Counsel to Intelsat Corporation, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 17-183, 18-122, at 2 (filed Apr. 23, 2018); *see also* NPRM ¶ 172.

⁵² *See infra* Section III.C.

introduction of any new adjacent-band terrestrial wireless services must include covering the cost of necessary new equipment, including filters and LNBS, as well as installation and maintenance costs, or equivalent lump-sum reimbursement at the earth station operator's request.⁵³

Co-Channel Sharing. The Commission should not authorize co-channel shared use by fixed P2MP users in the portion of the band that remains available for FSS use after any clearing. NCTA remains concerned that authorizing expanded co-channel sharing between satellite earth stations and terrestrial wireless services in the 3.7-4.2 GHz band poses a significant risk of harmful interference.⁵⁴ Proponents of introducing fixed P2MP operations have not provided adequate technical analysis to demonstrate that such new operations could be deployed without causing harmful interference to 3.7-4.2 GHz earth stations. In particular, the analysis filed by Google and the Broadband Access Coalition (BAC) earlier this year is premised on an assumption that far fewer earth stations operate across the country than are now registered,⁵⁵ leaving ample geographic areas where fixed P2MP services could be deployed. With 3.7-4.2 GHz earth station registrations reaching approximately 16,500 as of October 26, this analysis is out of date and cannot be used as the basis for Commission action. Moreover, even if co-channel fixed P2MP operations could be accommodated in a shared environment across the full 500 MHz of the today's 3.7-4.2 GHz band, the risk of harmful interference could be more acute in an environment where the Commission both reduces the amount of spectrum available for C-band

⁵³ See NPRM ¶ 172.

⁵⁴ NPRM ¶¶ 116, 118.

⁵⁵ See, e.g., Letter from Stephen E. Coran, Counsel to Wireless Internet Service Providers Association, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183, RM-11791, at Attachment 2, p. 14 (filed Mar. 29, 2018).

users (compressing today's operations into less spectrum) and introduces, for the first time, high power fixed P2MP operations.⁵⁶

Finally, the Commission has correctly stated that co-channel sharing between FSS and mobile operations would present significant harmful interference risks to FSS and would likely exclude a majority of the population from receiving wireless broadband service.⁵⁷ With large exclusion zones of up to 75 km around 3.7-4.2 GHz earth stations necessary to protect those operations from harmful interference,⁵⁸ mobile service operators would face many large holes across the country where mobile service could not be deployed. Given the lack of enthusiasm in the record to date from all sides (mobile carriers, chip vendors, satellite operators, and C-band customers) with regard to co-channel mobile operations,⁵⁹ the Commission has correctly focused the bulk of its proposed rulemaking on alternative opportunities for facilitating more intensive terrestrial use of the 3.7-4.2 GHz band.

C. Earth Station Operators Must Be Made Whole for Costs Incurred in Any Transition

Whether the Commission auctions spectrum or allows private parties to negotiate secondary market arrangements, existing C-band customers must be compensated for costs

⁵⁶ See *infra* Section III.D, for further discussion of the operational challenges associated with the Google and Broadband Access Coalition proposal to enable fixed P2MP deployment in shared spectrum by eliminating full-band, full-arc licensing.

⁵⁷ NPRM ¶ 52.

⁵⁸ See SES March Letter at 1.

⁵⁹ See, e.g., Comments of CTIA, GN Docket No. 18-122, at 5-6 (filed May 31, 2018); Intel, Intelsat, SES Mobile Now Comments at 4-6; Comments of Ericsson, GN Docket Nos. 18-122,17-183, at 2-3 (filed May 31, 2018); Comments of Nokia, GN Docket No. 18-122, at 3-4 (filed May 31, 2018); Reply Comments of the National Association of Broadcasters, GN Docket No. 18-122, at 3-4 (filed May 31, 2018); Comments of National Public Radio, Inc., GN Docket No. 18-122, at 11-12 (filed May 31, 2018); Content Companies Mobile Now Comments at 4-7.

incurred as a result of efforts to accommodate new terrestrial wireless broadband operations in the band.

If, in a potential band split scenario, all existing C-band services can be accommodated (with adequate room for growth) in the portion of the 3.7-4.2 GHz band that remains available for FSS use, we anticipate that the direct costs incurred by earth station operators would consist primarily of: (1) equipment, installation, and maintenance costs for new filters/LNBs; and (2) in some cases, costs for replacement earth station antennas and associated installation (including any necessary structural support) where installation of a filter on existing equipment does not adequately mitigate interference. As the Commission suggests, however, earth station operators should also be provided flexibility to elect a lump sum payment or other appropriate reimbursement most suited to their needs.⁶⁰

Moreover, as the Commission acknowledges, reducing the supply of C-band spectrum risks increasing the cost of C-band services and therefore indirectly increasing the ongoing operating costs of C-band customers.⁶¹ The Commission should require proponents of reallocation to analyze the impact of their proposed changes on the marketplace for C-band services. In particular, cost reimbursement models should build in an amount adequate to compensate C-band users for any ongoing operational impact of a reduction in total C-band spectrum. The Commission should include appropriate safeguards to prevent satellite licensees from increasing future costs for the same services as the result of the challenges of accommodating more customers and services in less bandwidth.

⁶⁰ NPRM ¶ 29.

⁶¹ *Id.* ¶ 63.

Finally, the Commission should not enable fixed P2MP use of remaining FSS spectrum. In addition to the technical and operational issues raised by proposals to share the reduced band on a co-channel basis, as discussed in more detail below, elimination of full-band, full-arc coordination and adoption of the Google/BAC proposal would impose real-time obligations on each earth station operators to inform the Commission and/or database of a frequency or antenna angle change.⁶² If the Commission enables shared fixed P2MP use of remaining FSS spectrum and imposes such obligations, earth station operators may incur additional costs that should be reimbursed.

D. The Full-Band, Full-Arc Policy Must be Retained to Ensure that Earth Station Operators' Need for Operational Flexibility to Quickly Repoint Antennas and Change Frequencies Can be Met

Contrary to the Commission's proposal,⁶³ the rules adopted in this proceeding should account for the need of fixed, temporary, and transportable earth station operators for flexibility to quickly repoint their antennas and/or switch frequencies when operational issues arise. In particular, the Commission should not abandon its full-band, full-arc licensing policy. Earth station operators continue to rely on the flexibility provided by full-band, full-arc licensing and neither stakeholders nor the Commission have offered any adequate alternative that would allow: (1) fixed earth station operators to switch satellites and/or transponders quickly and respond to

⁶² Comments of the Broadband Access Coalition, GN Docket No. 17-183, at 8 (filed Oct. 2, 2017) ("In the event the FSS earth station needs to temporarily or permanently change frequencies or point at a different position on the arc, the satellite operator would be required to update the database . . .").

⁶³ NPRM ¶¶ 39-40.

planned and unplanned outages; and (2) continued itinerant operations for newsgathering and live events.

As NCTA has described in previous comments,⁶⁴ its members rely on the ability to operate across the full geostationary arc and 3.7-4.2 GHz frequency range in order to maintain the operational flexibility necessary to respond to planned and unplanned outages. Satellite or transponder failures, sun outage events,⁶⁵ and end-of-life satellite transitions have all required earth station operators to repoint their antennas or change frequencies, sometimes on short notice.⁶⁶ Upon one satellite failure, one of NCTA's members was assigned a replacement transponder on an alternate satellite, which required both a frequency and antenna change. In 2005, a "zombie" satellite incident caused significant disruption and required earth stations to be repointed and to operate on alternate frequencies. In this instance, staff were moved to different sites and millions of dollars in materials and labor were spent to mitigate customer impact. In 2017, one satellite was declared a total loss due to accumulated solar array and battery failure, also requiring a member to repoint earth stations and/or change frequencies. Although operators may not be required to change frequencies or repoint antennas frequently, when the need arises to do so, operators must be able to make changes almost immediately in order to ensure a seamless television viewing experience for end-user customers.

Full-band, full-arc coordination is also critical for fixed temporary and transportable earth station operations. Typically, these are nomadic trucks used to cover breaking news, sports, and

⁶⁴ Comments of NCTA – The Internet & Television Association, GN Docket No. 18-122, at 9-10 (filed May 31, 2018) (NCTA Mobile Now Comments).

⁶⁵ A sun outage event takes place when the sun aligns directly with satellites and receiving earth stations and the sun's thermal noise interferes with reception.

⁶⁶ See NCTA Mobile Now Comments at 10.

other important live events. For live events, these trucks can communicate with more than fifteen satellites across the geostationary arc at various frequencies. While the trucks use C-band uplink to deliver the live programming back to NOCs, the trucks rely on downlink spectrum in the 3.7-4.2 GHz band to monitor onsite the quality of the video they are delivering and to verify use of the correct uplink frequency in order to avoid interference with other C-band operations. In some cases, C-band trucks also receive other live feeds via C-band from other venues to integrate into the feed sent on for distribution (for example during concerts or multi-venue events). The frequencies and antenna pointings for these operations are often selected on short notice, as the nomadic trucks typically arrive onsite the day before a scheduled event (and the same day for breaking news events) and must be able to respond to unanticipated idiosyncrasies of spectrum usage in particular locations (which could also change throughout the duration of the event). Consequently, full-band, full-arc coordination is also critical to ensure the reliable delivery of time-sensitive live programming.

Although frequency and antenna angle changes may not occur frequently today, the occurrence of such changes will likely increase if the Commission reduces the amount of spectrum available to accommodate C-band services. If overall capacity is reduced, each C-band satellite will have less available back-up bandwidth. Consequently, when a satellite experiences a transponder failure, it is less likely that a spare transponder will be available on the same satellite, requiring customers to change to a different satellite. This would result in repointing an earth station to the other satellite (requiring a change in antenna azimuth pointing and elevation

angles).⁶⁷ Consequently, the need to retain full-band, full-arc licensing and to ensure that FSS sites are fully protected from mobile interference over the entire arc becomes more acute if the Commission reduces the total amount of spectrum available for FSS use.

The Commission should not end its full-band, full-arc policy. However, if the Commission intends to move forward, it must first put in place an adequate alternative that will result in equivalent protection for earth station operators. Such operators must be allowed to change frequencies and antenna pointings on short notice without prior approval or burdensome notification requirements if television consumers across the country are to continue to receive uninterrupted programming. Neither coordination nor Commission approval should be required prior to changing frequencies or antenna pointings within the portion of the band that remains available for FSS use. Requiring Commission approval before a change, as the Commission appears to contemplate,⁶⁸ could mean that television services go off the air for a large number of customers until an antenna or frequency modification is approved. This approach would also significantly increase the burden on Commission staff to process quick-turnaround requests for modification and requests for special temporary authority for modified frequencies and antenna pointings.

Requiring the submission of a coordination report before the Commission processes a request to change antenna angles or frequencies would prove still more burdensome. NCTA

⁶⁷ C-band backhaul of live programs from overseas will also be affected by any C-band reallocation. Although an international satellite operator may not need to reduce its use of C-band spectrum on a trans-Atlantic or Trans-Pacific satellite, a U.S. operator's choice of transponder for the backhaul will be limited to only those frequencies still allocated for FSS use in the United States. This may limit U.S. programmers' ability to achieve satisfactory diversity on their international feeds into the United States.

⁶⁸ NPRM ¶ 39.

understands that the coordination process with fixed links today can take between four and six weeks; this would prove an unacceptably long time for television service to go off-air while operators seek approval for necessary changes. To date, neither stakeholders nor the Commission have offered any adequate alternative to full-band, full-arc licensing that would accommodate planned/unplanned satellite outages and itinerant users. An equivalent alternative must be established before the Commission considers disrupting the video distribution supply chain.

IV. AUCTIONS, MARKET-BASED MECHANISMS, AND CO-CHANNEL P2MP SHARING PROPOSALS ALL PRESENT SPECIFIC PROBLEMS AND WOULD REQUIRE SPECIFIC PROTECTIONS FOR INCUMBENTS

To date, no party has put on the record sufficient detail surrounding any of the proposals for facilitating more intensive terrestrial wireless use of the 3.7-4.2 GHz band to enable NCTA to support a particular approach. Each of the proposals put forth in the NPRM presents particular challenges and drawbacks from the perspective of ensuring robust protections for existing C-band users.

Market-Based Approach. A market-based approach presents substantial challenges that the Commission should carefully consider. Given its obligation to regulate spectrum in a manner that promotes “public convenience, interest, or necessity,”⁶⁹ the Commission should be cautious in ceding this responsibility to private parties. The incentives of the satellite licensees that propose to make up the Transition Facilitator (CBA) may not be co-extensive with the interests of their customers. While the satellite licensees will have a strong incentive to maximize revenue, their customers (from a cable perspective, programmers and earth station operators)

⁶⁹ 47 U.S.C. § 303.

prioritize adherence to the four principles articulated in Section III above, which will enable them to continue to provide high-quality service to their end-user customers.

Accordingly, if it adopts a market-led approach to clear a portion of the 3.7-4.2 GHz band, the Commission should first require any Transition Facilitator to provide publicly an adequately detailed transition plan that discloses sufficient detail for customers and earth station operators to ensure that their needs will be met.⁷⁰ At a minimum, such a plan must describe: (1) continuity of operation plans for each affected satellite customer and earth station operator, including whether that operator must change frequencies or transition to an alternative transmission mechanism and the date by which any changes will be accomplished; (2) the dollar amount of compensation to be paid out to each affected earth station operator and plans for ensuring sufficient funds will be placed in escrow to cover such costs; (3) plans to provide any replacement or alternative equipment and associated installation and plans for alternative reimbursement elections such as a lump-sum payment; and (4) how the plan will accommodate growth over time, including the need for new earth station sites and antennas and an eventual transition to higher resolution (ultra-high-definition) transmissions that may require additional bandwidth.

Second, the Commission should put any transition facilitation plan out for public comment (as it has in similar cases involving the activities of private parties⁷¹). This is the best way to ensure that the results of a negotiation process among private parties adequately accounts for the interests of all stakeholders and that protected earth stations will indeed be protected.⁷² If the

⁷⁰ NPRM ¶ 80.

⁷¹ *See Public Safety and Homeland Security Bureau Seeks Comment on Wireless Carriers' Privacy and Security Plan for the National Emergency Address Database (NEAD)*, Public Notice, 32 FCC Rcd. 1471 (rel. Feb. 28, 2017).

⁷² *See* NPRM ¶¶ 83, 88.

Commission determines, after reviewing the comments, that the plan does not adequately account for the interests of all stakeholders and/or does not fully protect earth station operators (including if provision has not been made for neutral resolution of any disputes and for adequate public interest oversight by the Commission), it should require the Transition Facilitator to file a revised plan. Furthermore, to ensure that the consortium remains accountable for its commitments to C-band customers, the Commission, and the public, the Commission should condition its approval for any private approach on fulfilling the obligations set forth in the transition facilitation plan.

Third, NCTA agrees that the Commission should condition license authorization on the licensee's agreement that it will not commence operations until protections for incumbent earth stations have been completed.⁷³ The Commission's rules should memorialize this condition and provide an adequate mechanism for such rules and conditions to be monitored and enforced. Under the band-split approach proposed to accompany the market-led negotiation process, all earth station operators would be required to install new equipment, and many would be required to change frequencies and antenna angles. These changes must be completed, successfully tested, and approval by the earth station operator verified to the Commission, before the Commission may grant a green light to new wireless operators to commence high-power deployments in the vicinity.

Finally, while NCTA would not support revisiting efforts to clear additional spectrum after an amount is established in a transition facilitation plan, if satellite licensees and wireless

⁷³ *Id.* ¶ 90.

carriers wish to undertake multiple rounds of negotiation and clearing over time to make available more spectrum for terrestrial wireless use, as the Commission suggests,⁷⁴ each such round of negotiations should commence only after the Commission provides an opportunity for notice and comment on the proposal to clear additional frequencies and after substantive mobile deployment is achieved on portions of the band already cleared. As NCTA notes above, the number one priority of C-band customers is preventing adverse impact to their existing operations, including preserving sufficient capacity for back-up and future growth. If the original transition facilitation plan filed is consistent with accommodating all today's C-band needs, but the transition facilitator and wireless licensees continue to negotiate to clear additional frequencies up to the full 500 MHz, the potential for negative impact to existing C-band users increases substantially. Accordingly, the Commission should not give any private approach free reign to clear up to the full 500 MHz; proposals to clear additional frequencies should be filed with the Commission, accompanied by sufficiently detailed new transition plans, to enable C-band customers to comment and the Commission to make a new determination.

Auction Mechanisms. If the Commission adopts an auction approach, it should ensure that earth station operators and other satellite customers may participate directly in mechanisms for determining the socially optimal amount and value of cleared spectrum. For example, in an overlay auction,⁷⁵ this means that overlay licensees should be required to negotiate with *all* users in their geographic area, including not only the satellite provider, but also capacity/transponder lessees, and earth station operators, regarding how much of the band can be cleared and what

⁷⁴ *Id.* ¶ 72.

⁷⁵ *See id.* ¶ 100.

compensation would be required to make customers/earth station operators whole. Similarly, in an incentive auction approach,⁷⁶ this means designing a reverse auction where not just the satellite licensees, but their customers and earth station operators, can tell the Commission directly how they value their current C-band usage and under what circumstances they would be willing to limit or discontinue operations in part of the band. Finally, in a capacity auction,⁷⁷ earth station operators and satellite customers should be eligible to offer to relinquish their rights to, or current usage of, capacity on specific transponders in any reverse capacity auction.

Co-Channel Fixed P2MP Access. The Commission should not authorize fixed P2MP users to share with remaining FSS operations without a demonstration that harmful interference concerns can be resolved, and a satisfactory mechanism in place to accommodate frequency and antenna pointing changes. As NCTA notes above in Section III.B, harmful interference remains a significant concern, particularly given the much larger number of registered earth stations than proponents of fixed P2MP access assume in their analysis. These concerns could be even more acute if the Commission both reduces the amount of spectrum available to accommodate today's operations and enables more intensive co-channel terrestrial sharing.

Moreover, as noted in Section III.D, full-band, full-arc protection remains critical to enable seamless television delivery in the case of outages, failures, end-of-life transitions, and to accommodate itinerant C-band users. Proponents of co-channel fixed P2MP access have not proffered an adequate alternative to full-band, full-arc licensing to meet this need. These issues must be addressed before the Commission seriously considers any proposal to expand terrestrial fixed wireless access to new P2MP users.

⁷⁶ See *id.* ¶ 105.

⁷⁷ See *id.* ¶ 106.

V. THE COMMISSION SHOULD NOT LIMIT REGISTRATION OF NEW EARTH STATIONS OR REQUIRE ADDITIONAL BURDENSOME INFORMATION COLLECTIONS FROM EARTH STATION OPERATORS

The Commission proposes to severely curtail the deployment of new earth station facilities, and to introduce burdensome new reporting requirements on earth station registrants. NCTA opposes these proposals. Efforts to accommodate new terrestrial wireless licensees in the band should ensure an adequate path for C-band users to grow into the future, in terms of both capacity and earth station siting needs. Moreover, reporting requirements should be tailored only to what is necessary to accommodate new users. The Paperwork Reduction Act and its implementing regulations prevent the Commission from seeking information for information's sake and prohibit the establishment of reporting requirements where the information collection has no practical utility.⁷⁸

The Commission seeks comment on revising the Part 25 rules to allow today's earth station operators to "modify the[ir] stations at the registered location but not add new stations in new locations," and to prohibit applications for new earth station registrations.⁷⁹ This approach would unnecessarily curtail important C-band operations. Earth station operators should be able to continue their operations and business plans unimpeded in the spectrum that remains available for their use, including adding new earth stations at new locations, relocating existing earth stations, and applying for new earth station registrations where necessary. Several of NCTA's members have shared plans to deploy new earth station facilities in the near term and such plans should proceed without obstacle in the spectrum that remains available for FSS use after any transition. Moreover, earth station operators require flexibility to install new (and relocate

⁷⁸ See 44 U.S.C. § 3504(c)(3)-(4); 5 C.F.R. § 1320.5(d)(1).

⁷⁹ NPRM ¶ 30.

existing) earth stations in certain situations, including, for example, changing demands from a property owner, new construction that compromises current sight lines, and other circumstances. This approach would adequately balance the needs of existing C-band users and future terrestrial wireless operations. Wireless operators in the lower portion of the band cleared for their use would be unaffected by new earth station locations that limit their frequency use to the spectrum not cleared.

The Commission also proposes to require earth station operators to provide new categories of information to the Commission. Some of the information itemized in paragraph 41 of the NPRM is already required by Form 312, but some would constitute a new information collection burden.⁸⁰ Specifically, the Commission’s proposal to require earth station operators to submit a specific azimuth and elevation (rather than the eastern- and western-most limits associated with a wide swath of the geostationary arc) would be a new requirement for operators. Similarly, earth station operators may select “permitted list” today on Form 312 rather than provide one specific satellite with which the earth station intends to communicate. This means that earth stations may be granted authorization to receive transmissions from all U.S.-licensed and foreign-licensed C-band satellites authorized to serve the U.S. that are within the satellite coordination arc. A requirement to list the specific satellite at which the earth station is pointed at the time of registration would constitute a new, constraining burden. Finally, the Commission proposes to require that earth station operators list specific transponder numbers in use at the time of registration and disclose how often each transponder is used (regularly, infrequently, or as back-up capacity).⁸¹ Today, registrants may list the full frequency band (3700-4200 MHz), which, as

⁸⁰ See *id.* ¶ 41.

⁸¹ *Id.*

described in Section III.C, above, provides them protection across the full frequency band, enabling quick changes in frequency in the case of a failure, outage, or other need. Listing specific transponders and frequency of use would be a new requirement for earth station operators (and could likely be readily provided by a handful of space station operators instead). The Commission also inquires whether it should go even further and require earth station operators to submit “more granular” data, including “additional information on transponder loading, content type, content provider information, [and] periodic usage.”⁸²

The anticipated burdens associated with requiring operators to file this additional data far outweigh the anticipated public benefits. From a large operator perspective, NCTA members anticipate the burden of providing the new earth station data in paragraph 41 could exceed 2,400 hours, with a one-time cost of approximately \$462,000 per operator. If the Commission also requires operators to submit the additional information identified in paragraph 42, this could require an additional 2,850 hours of employee time to complete and cost an additional \$170,600 per operator. To update the information on an ongoing basis when changes occur would likely require an additional 5,277 hours of employee time at a total cost of \$632,600 per year.

From a small operator perspective, NCTA members anticipate the burden of providing the new earth station data in paragraph 41 would exceed 120 hours of employee time, costing approximately \$8,000-\$12,000 per operator, plus additional engineering and consulting costs (which could exceed \$5,000). Those costs would increase if the Commission went further to require the submission of the data described in paragraph 42. To update the information on an

⁸² *Id.* ¶ 42.

ongoing basis when changes occur would likely require an additional 60 hours of employee time at a total cost of \$6,000 per operator per year.

These substantial costs significantly outweigh the potential public benefit of submitting additional information. NCTA understands that none of this information is required in order to facilitate a band-split approach. Which frequencies, antenna angles, and transponders earth station operators use within the spectrum that remains available for FSS use has no bearing on the ability of new terrestrial mobile operators to use any portion of spectrum cleared to accommodate their operations. Therefore, there is no anticipated public benefit and no practical utility in requiring submission of this information in terms of coexistence with new adjacent mobile users.

It is premature to say whether the disclosure of this information could lead to public benefits in terms of enabling coexistence with co-channel fixed P2MP operations. As noted in Sections III.B and III.D, above, the business case for and potential benefits of shared co-channel use have been examined only in the context of an environment with a very limited number of deployed earth stations (those on file with the Commission prior to the April 19 Public Notice urging registration of all 3.7-4.2 GHz earth stations). Before the Commission can weigh the significant costs of providing additional earth station registration data against the potential benefits of submission to facilitate co-channel sharing, proponents of fixed P2MP access must submit an updated study demonstrating the feasibility of their approach in an environment with many more earth stations than initially accounted for and the potential public benefits of such approach.

The Commission should not limit registration and licensing of C-band earth stations to particular combinations of static frequency, azimuth, and elevation angle and should not

discontinue registration for such parameters if unused in any 180-day period.⁸³ As described in Section III.D above, earth station operators require flexibility to repoint and change frequencies, sometimes on short notice, and should not be required to file and wait for Commission approval before making such changes. Unless proponents of discontinuing full-band, full-arc licensing arrive at a satisfactory approach to enable earth station operators to make immediate frequency and antenna angle changes, the Commission should not discontinue the current practice in its Form 312 registration process.

VI. CONCLUSION

For the foregoing reasons, NCTA asks that, regardless of the approach it adopts to facilitate more intensive terrestrial wireless use of the 3.7-4.2 GHz band, the Commission protect today's C-band users by: (1) preventing adverse impact to all current and future C-band services, including ensuring room for growth and requisite back-up capacity; (2) protecting earth station operators from harmful interference that could result from new adjacent mobile services and any new in-band fixed P2MP services; (3) making earth station operators whole for the costs that they incur in any transition to accommodate new services; and (4) retaining the full-band, full-arc policy to meet earth station operators' operational need for flexibility to repoint antennas and change frequencies, sometimes on short notice. The Commission should also preserve the ability of C-band operators to continue to make intensive, efficient use of the spectrum that remains available for their operations by continuing to permit registration of new earth station locations and facilities using those frequencies, and should not impose burdensome new reporting requirements.

⁸³ *Id.* ¶¶ 35-36.

Respectfully submitted,

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